RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_RF_SL18050101-SPC-004_B48
Supersede Report No.:

Applicant	SpiderCloud Wireless, Inc.
Product Name	SpiderCloud Radio Node
Model No.	SCRN-330-4148
Test Standard	47CFR Part96
Test Method	TIA-603-E: 2016
FCC ID	Y47RN334148
Date of test	07/01/2018-07/12/2018
Issue Date	08/06/2018
Test Result	Pass Fail
Equipment complied with the specification	[x]
Equipment did not comply with the specification	[ ]

Gary Chou	Chen Ge
Test Engineer	Engineer Reviewer

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Test result presented in this test report is applicable to the tested sample only

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA

A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC , RF/Wireless , Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless , Telecom
Taiwan	BSMI , NCC , NIST	EMC, RF, Telecom , Safety
Hong Kong	OFTA , NIST	RF/Wireless ,Telecom
Australia	NATA, NIST	EMC, RF, Telecom , Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF , Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom , Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC , RF , Telecom
Canada	IC FCB , NIST	EMC , RF , Telecom
Singapore	iDA, NIST	EMC , RF , Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF , Telecom
HongKong	OFTA (US002)	RF , Telecom

CONTENTS

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_RF_SL18050101-SPC-004_B48	None	Original	08/06/2018

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: SpiderCloud Wireless, Inc.
Product: SpiderCloud RadioNode
Model: SCRN-330-4148

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	SpiderCloud Wireless
Applicant Address	475 Sycamore Dr, Milpitas, CA, 95035, USA
Manufacturer Name	SpiderCloud Wireless
Manufacturer Address	475 Sycamore Dr, Milpitas, CA, 95035, USA

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	SpiderCloud RadioNode
Model No.	SCRN-330-4148
Trade Name	SpiderCloud
Serial No.	N/A
Input Power	56VDC
Power Adapter Manu/Model	N/A
Date of EUT received	10/20/2015
Equipment Class/ Category	PCB, TNB
Operating Frequencies	LTE: TX (3550 MHz to 3700 MHz), RX (3550 MHz to 3700 MHz)
Port/Connectors	N/A
Remark	NONE

6.2 Radio Description

Item	LTE
Operating Band /Radio Type	LTE Band 48
Bandwidth	10MHz, 20MHz
Modulation	QPSK/16QAM/64QAM
Antenna Type	Internal Omni-directional antenna
Antenna Gain	5 dBi
Frequency TX(MHz)	TX: 3550 MHz to 3700 MHz RX: 3550 MHz to 3700 MHz

6.3 EUT test modes/configuration Description

Test mode

Final Test Mode		Note
Final_test_mode	Continuous transmission	LTE
Remark: N/A.		

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	PoE Adatper	POE36U-1AT-R	P90212324A1	Phihong	-
2	Laptop	E6400	N/A	Dell	-
					-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
							-
							-

7.3 Test Software Description

Test Item	Software	Description
RF testing	TmcDvtClient	Enable EUT continuous TX mode and change to different channel

8 Test Summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
E.I.R.P	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Power Spectrum Density	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Emission Bandwidth	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Peak-Average Ratio	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Spurious and harmonic Emission at antenna port	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Out of Band Emissions	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Radiated spurious and harmonic emission	FCC	47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Frequency stability	FCC	47CFR2.1053, 47CFR96.41	FCC	TIA-603-E: 2016	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9 Measurement Uncertainty

9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					**3.856266**

The total derived measurement uncertainty is +/- 3.86 dB.

9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

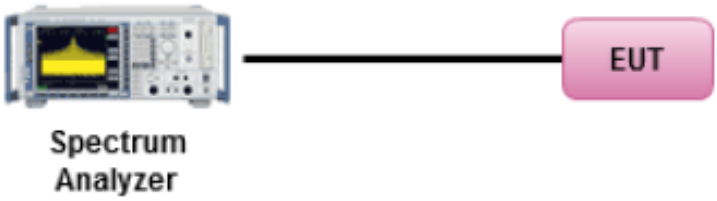
Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 E.I.R.P

Requirement(s):

<table>
<tr><td>Spec</td><td>Requirement</td><td>Applicable</td></tr>
<tr><td>47CFR96.41</td><td>Power limits. Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):
<table>
<tr><th>Device</th><th>Maximum EIRP (dBm/10 megahertz)</th><th>Maximum PSD (dBm/MHz)</th></tr>
<tr><td>End User Device</td><td>23</td><td>n/a</td></tr>
<tr><td>Category A CBSD</td><td>30</td><td>20</td></tr>
<tr><td>Category B CBSD[1]</td><td>47</td><td>37</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Procedure</td><td colspan="2">- EUT was set for low, mid, high channel with modulated mode and highest RF output power.
- The spectrum analyzer was connected to the antenna terminal.</td></tr>
<tr><td>Test Date</td><td>07/11/2018</td><td>Environmental condition
Temperature 22°C
Relative Humidity 48%
Atmospheric Pressure 1008mbar</td></tr>
<tr><td>Remark</td><td colspan="2">EUT is a class A CBSD, the EUT has two antennas with each individual gain = 5dBi, therefore, the directional gain of the EUT is 5+10*log(2) = 8 dBi.</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

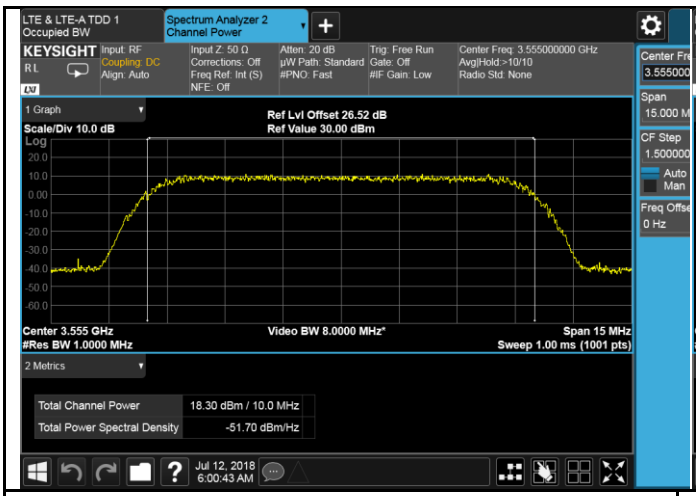
Test was done by Chen Ge at RF Test Site.

Test Data:

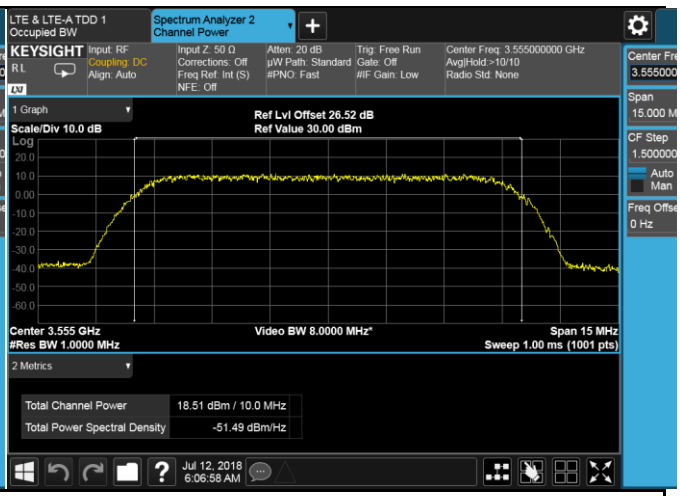
Type	Channel	Frequency (MHz)	Port 1(dBm)	Port 2(dBm)	Combined Power (dBm)	Directional Gain (dBi)	E.I.R.P (dBm)
10MHz BW, 64QAM	Low	3555	18.30	18.51	21.42	8	29.42
	Mid	3625	17.78	17.91	20.86	8	28.86
	High	3695	17.92	17.80	20.87	8	28.87
20MHz BW, 64QAM	Low	3560	17.82	18.01	20.93	8	28.93
	Mid	3625	18.45	18.79	21.63	8	29.63
	High	3690	18.37	19.05	21.73	8	29.73

Note: The total power was tested with integrated bandwidth of 10MHz and 20MHz, which shows the worst case.

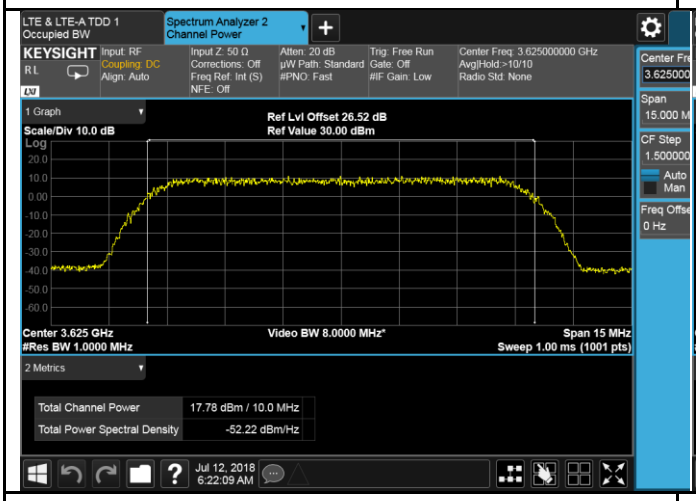
Test Plots:



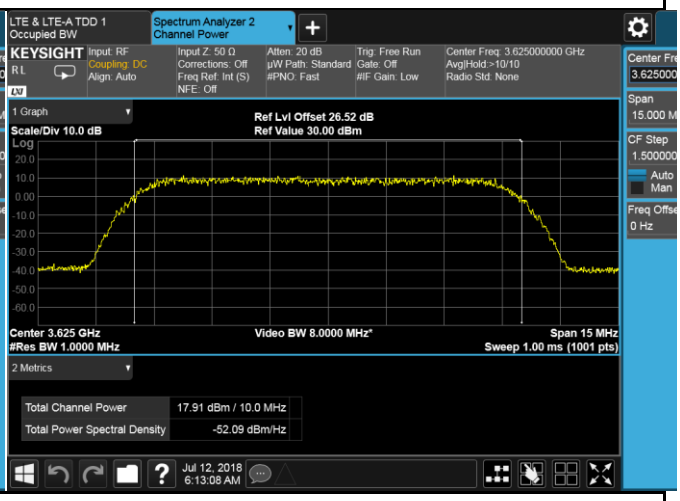
10M 64QAM -Low CH-Port1



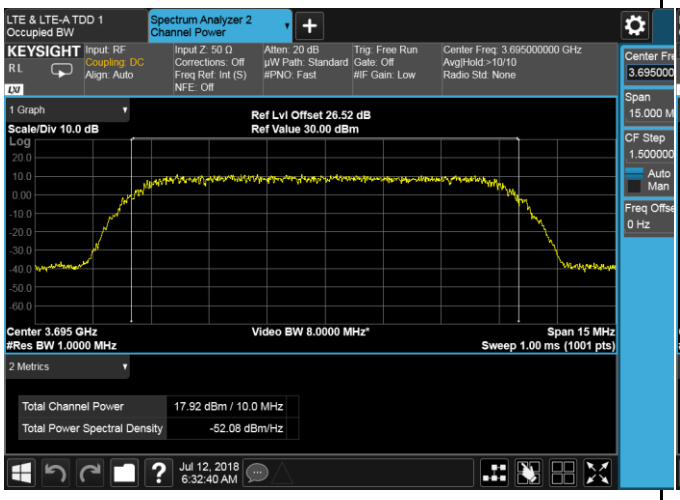
10M 64QAM -Low CH-Port2



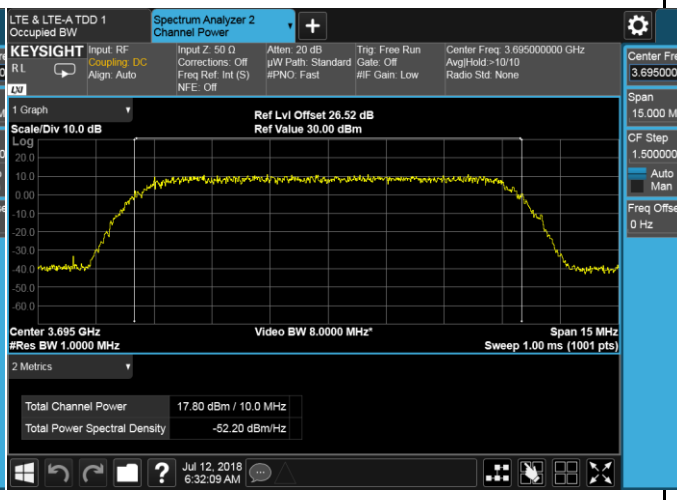
10M 64QAM -Mid CH-Port1



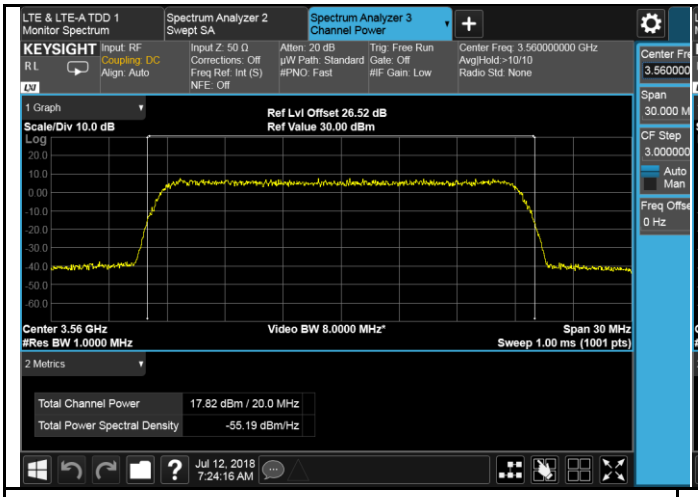
10M 64QAM -Mid CH-Port2



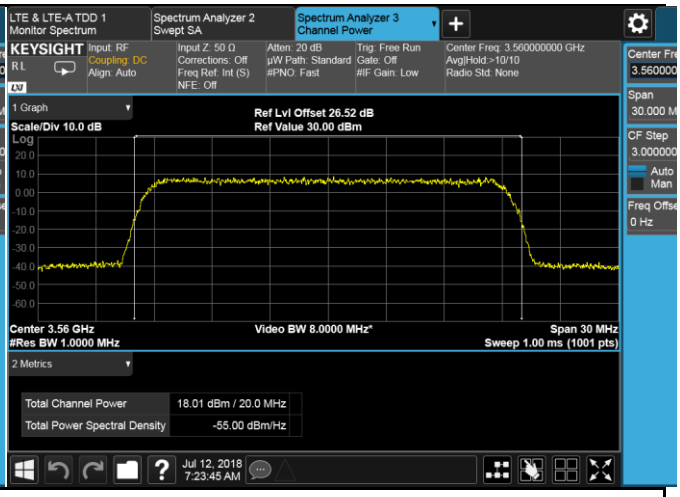
10M 64QAM -High CH-Port1



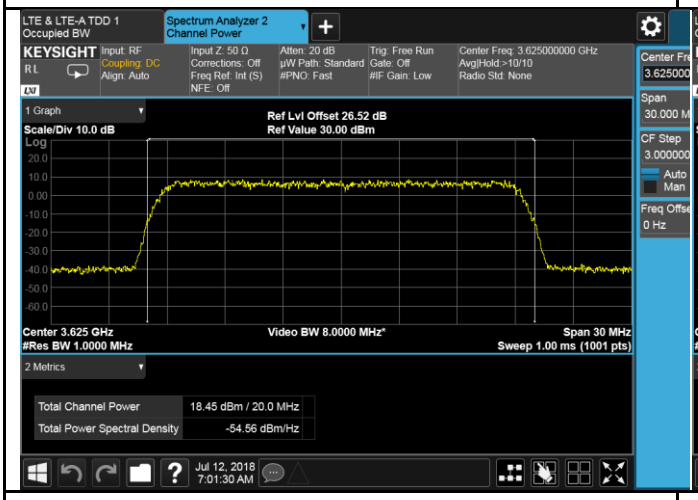
10M 64QAM -High CH-Port2



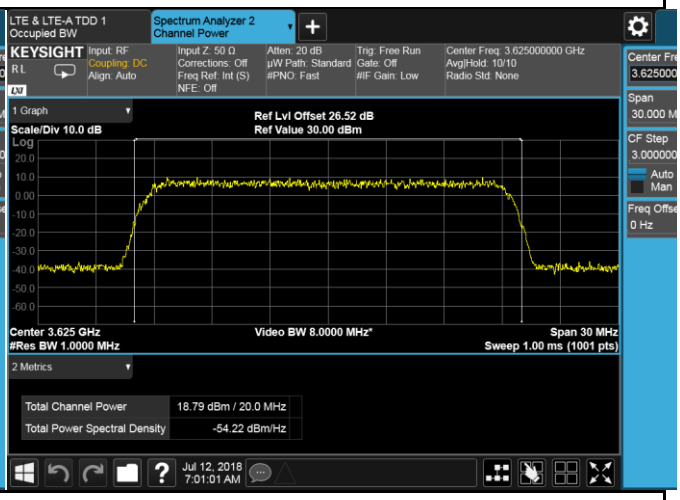
20M 64QAM -Low CH-Port1



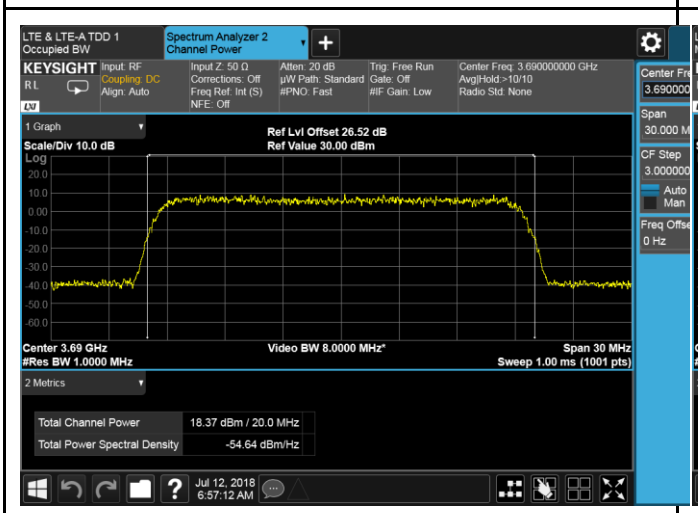
20M 64QAM -Low CH-Port2



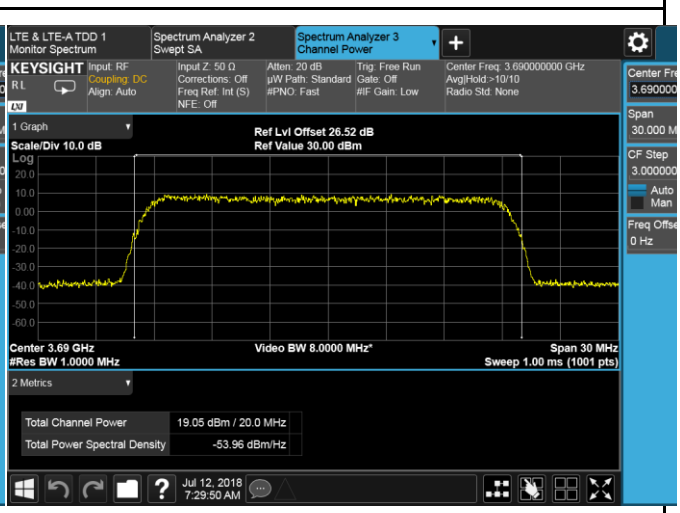
20M 64QAM -Mid CH-Port1



20M 64QAM -Mid CH-Port2



20M 64QAM -High CH-Port1



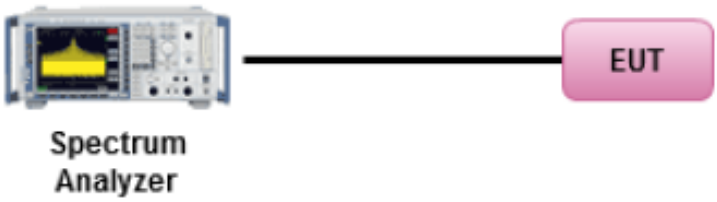
20M 64QAM -High CH-Port2

10.2 Power Spectrum Density

Requirement(s):

Spec	Requirement	Applicable
47CFR96.41	*Power limits.* Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):	☒

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD[1]	47	37

Test Setup			
Test Procedure	- EUT was set for low, mid, high channel with modulated mode and highest RF output power. - The spectrum analyzer was connected to the antenna terminal.		
Test Date	07/11/2018	Environmental condition	Temperature 22°C Relative Humidity 48% Atmospheric Pressure 1008mbar
Remark	EUT is a class A CBSD, the EUT has two antennas with each individual gain = 5dBi, therefore, the directional gain of the EUT is 5+10*log(2) = 8 dBi.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

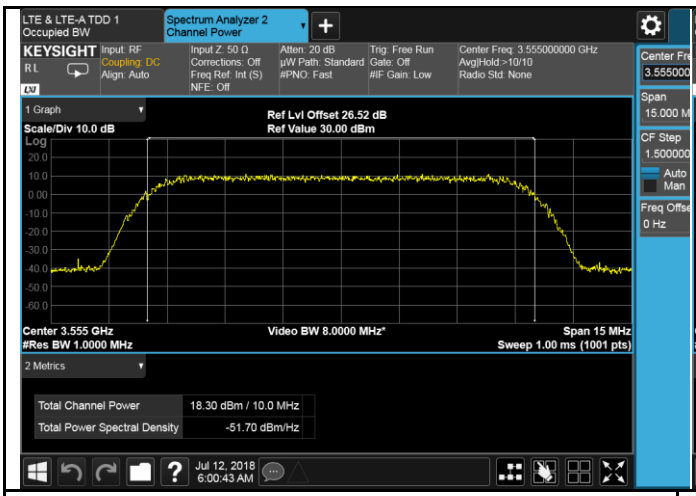
Test was done by Chen Ge at RF Test Site.

Test Data:

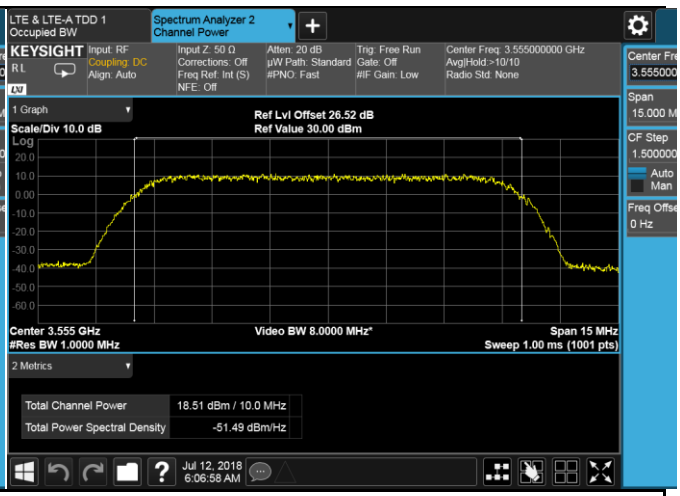
Type	Channel	Frequency (MHz)	Port 1(dBm)	Port 2(dBm)	Combined Power (dBm)	PSD (dBm/MHz)	Directional Gain (dBi)	E.I.R.P (dBm)
10MHz BW, 64QAM	Low	3555	18.30	18.51	21.42	11.42	8	19.42
	Mid	3625	17.78	17.91	20.86	10.86	8	18.86
	High	3695	17.92	17.80	20.87	10.87	8	18.87
20MHz BW, 64QAM	Low	3560	17.82	18.01	20.93	7.92	8	15.92
	Mid	3625	18.45	18.79	21.63	8.62	8	16.62
	High	3690	18.37	19.05	21.73	8.72	8	16.72

Note: The BW of 10MHz and 20MHz were used for PSD calculation.
The PSD level was calculated using total power / BW, 10MHz and 20MHz were used for calculation.

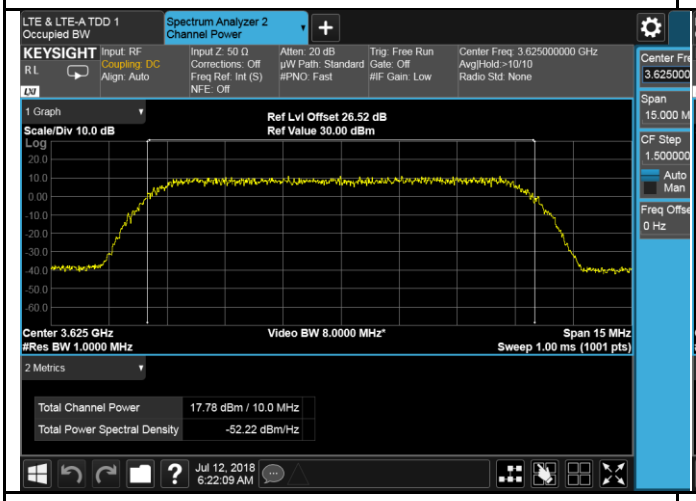
Test Plots:



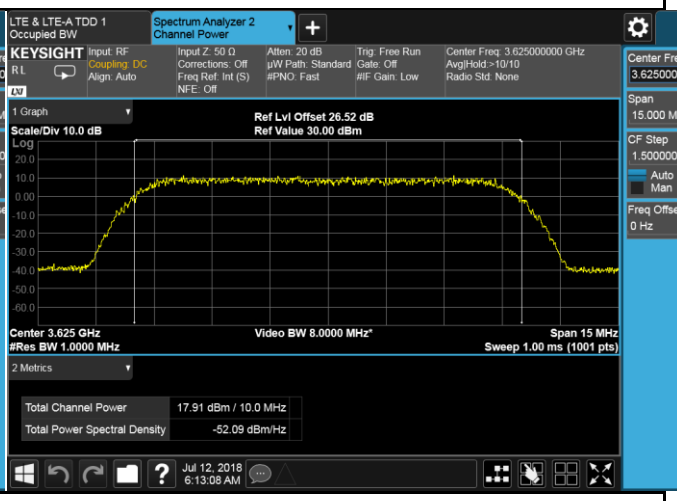
10M 64QAM -Low CH-Port1



10M 64QAM -Low CH-Port2



10M 64QAM -Mid CH-Port1



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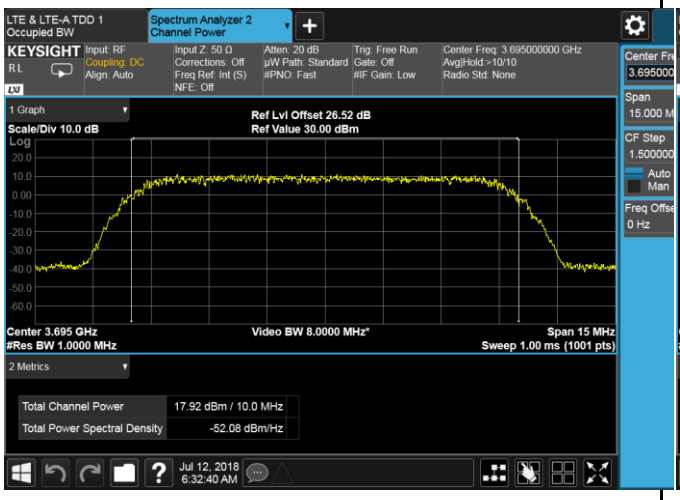
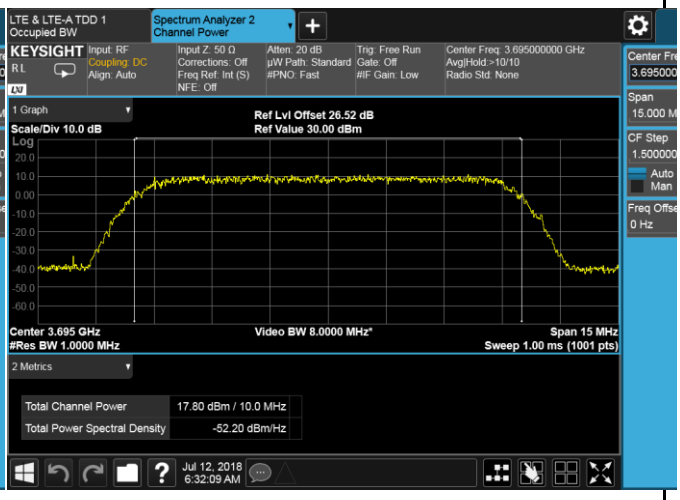


10M 64QAM -High CH-Port1



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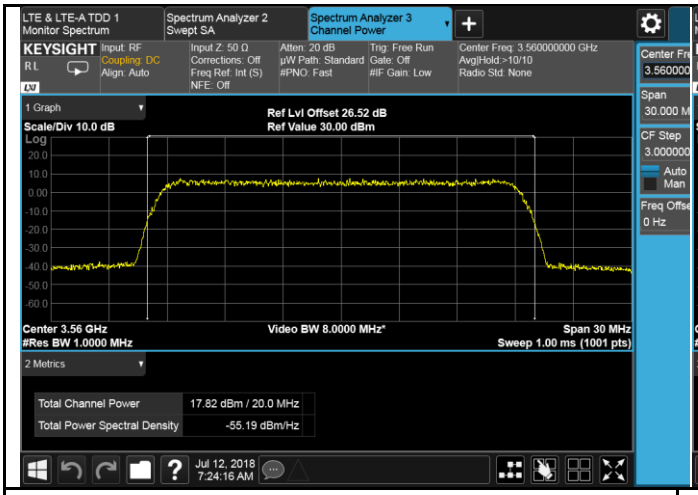
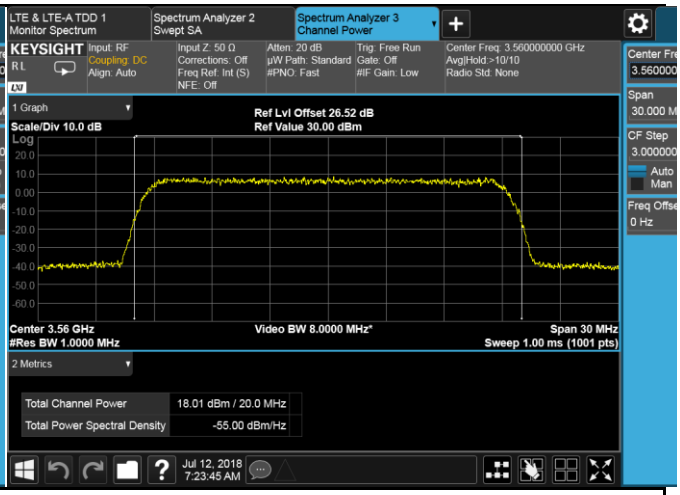
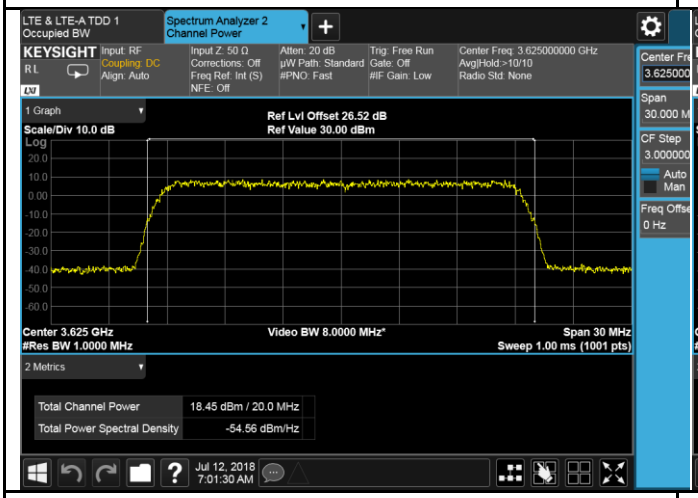


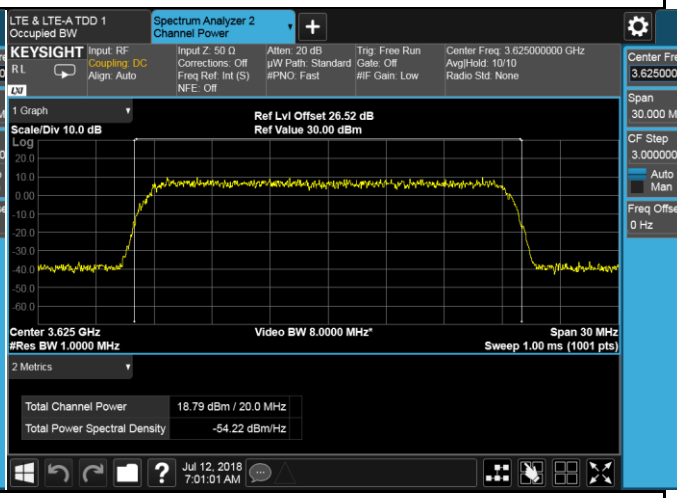
20M 64QAM -Low CH-Port1



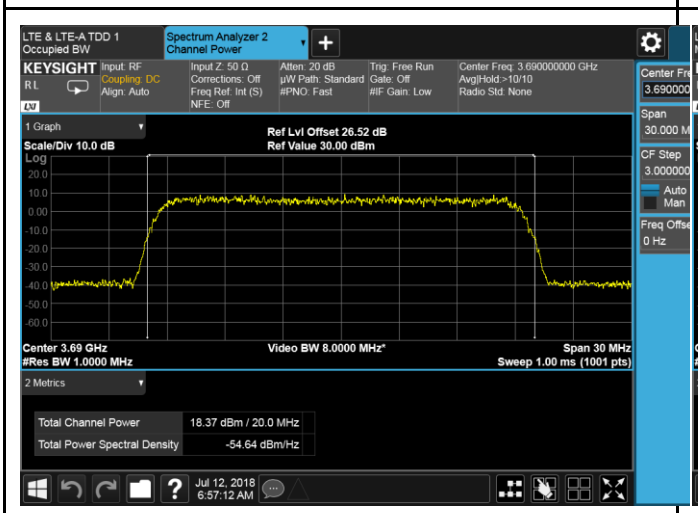
20M 64QAM -Low CH-Port2



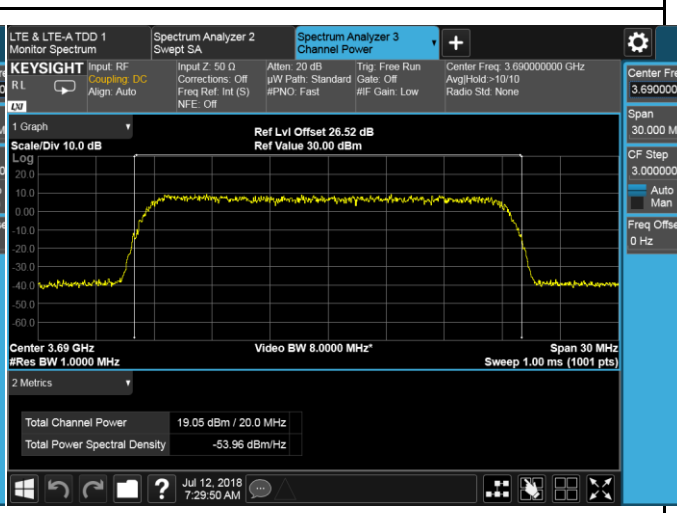
20M 64QAM -Mid CH-Port1



20M 64QAM -Mid CH-Port2



20M 64QAM -High CH-Port1

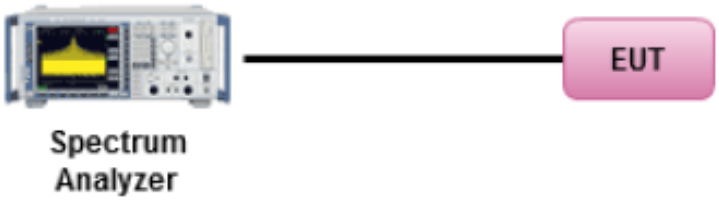


20M 64QAM -High CH-Port2

10.3 Peak-Average Ratio

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR96.41	(g)	*Power measurement.* The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.	☒

Test Setup				
Test Procedure	- EUT was set for low, mid, high channel with modulated mode and highest RF output power. - The spectrum analyzer was connected to the antenna terminal.			
Test Date	07/11/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 48% 1008mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

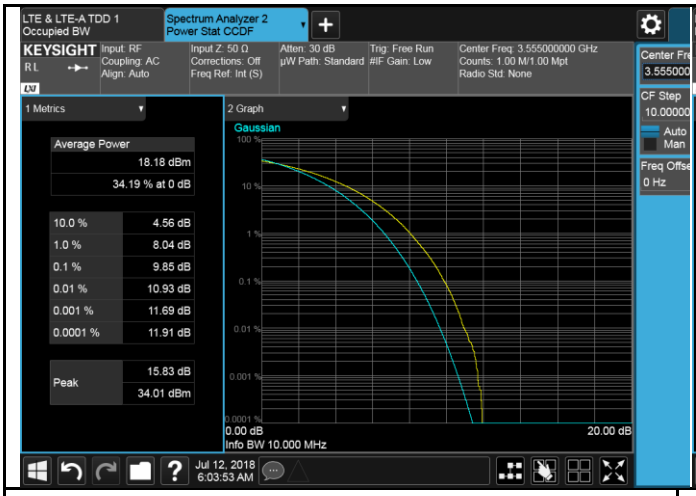
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF Test Site.

Test Data:

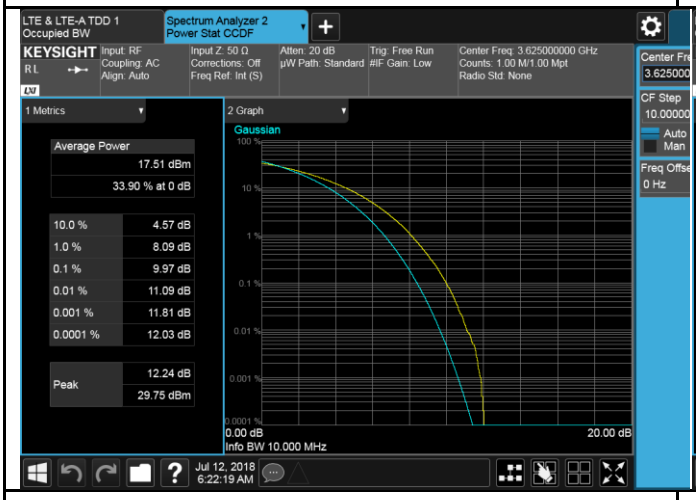
Type	Channel	Frequency (MHz)	Peak-Average Ratio (dB)	Peak-Average Ratio (dB)
10MHz BW, 64QAM	Low	3555	9.85	13
	Mid	3625	9.97	13
	High	3695	9.87	13
20MHz BW, 64QAM	Low	3560	9.71	13
	Mid	3625	9.80	13
	High	3690	9.76	13

Test Plots:

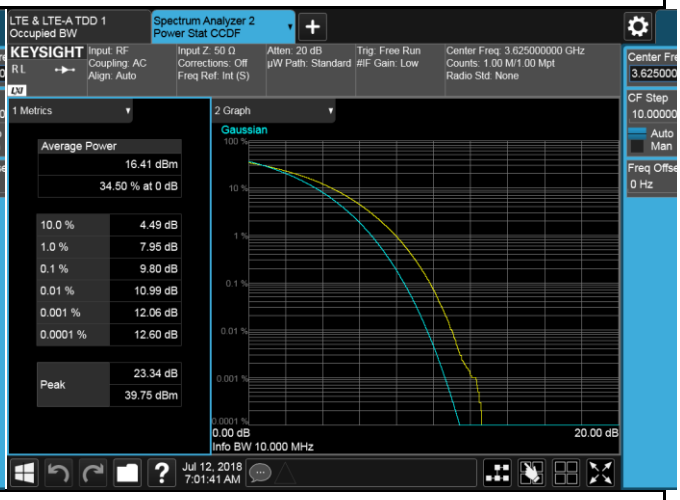


PK-AV-Ratio -64QAM-10M BW-Low

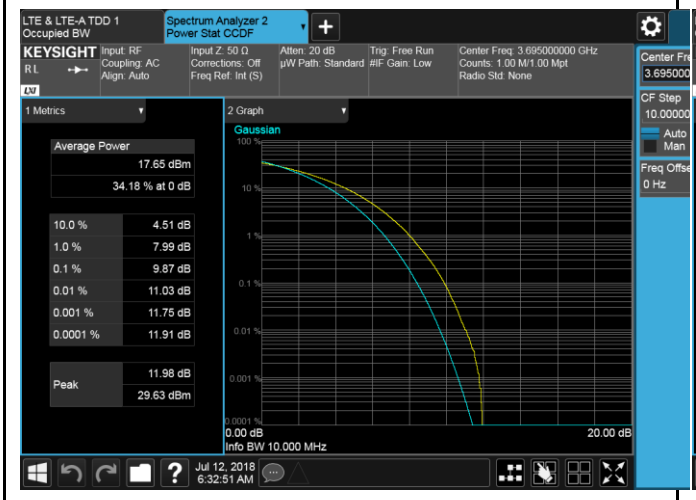
PK-AV-Ratio -64QAM-20M BW-Low



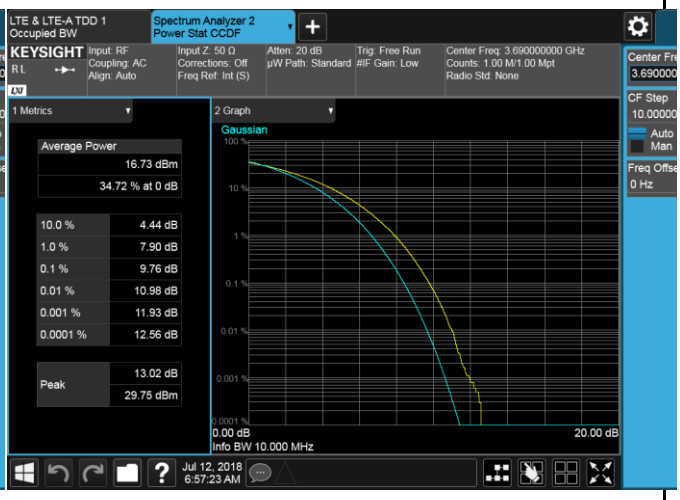
PK-AV-Ratio -64QAM-10M BW-Mid



PK-AV-Ratio -64QAM-20M BW-Mid



PK-AV-Ratio -64QAM-10M BW-High

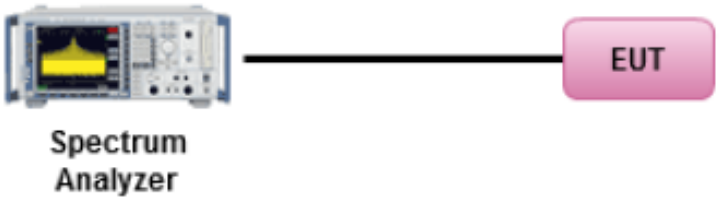


PK-AV-Ratio -64QAM-20M BW- High

10.4 Occupied Bandwidth

Requirement(s):

Spec	Requirement	Applicable
47 CFR §2.1049 47CFR96.41	The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions of § 2.1049 (a) through (i) The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.	☒

Test Setup			
Procedure	99% Occupied bandwidth measurement procedure - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 26 dB bandwidth 99% OBW. ○ Set RBW = 1% -5% of Emission Bandwidth ○ Set VBW = approximately 3 x RBW ○ Detector = Peak ○ Trace mode = max hold ○ Sweep = auto couple - Capture the plot. Repeat above steps for different test channel and other modulation type.		
Test Date	07/11/2018	Environmental condition	Temperature 22°C Relative Humidity 48% Atmospheric Pressure 1008mbar
Remark	NONE		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

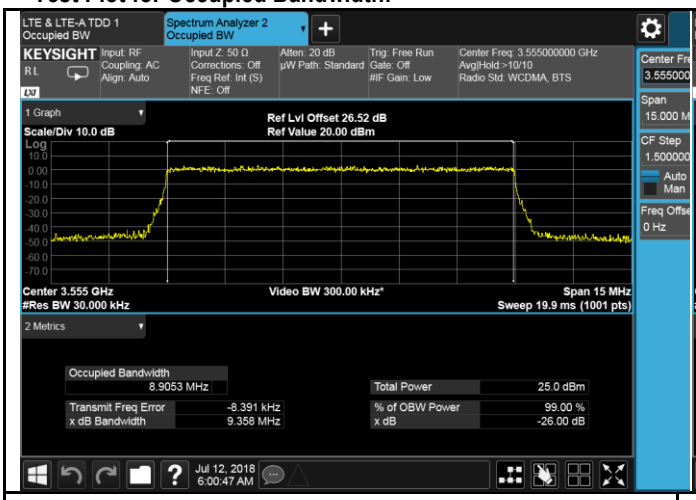
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF Test Site.

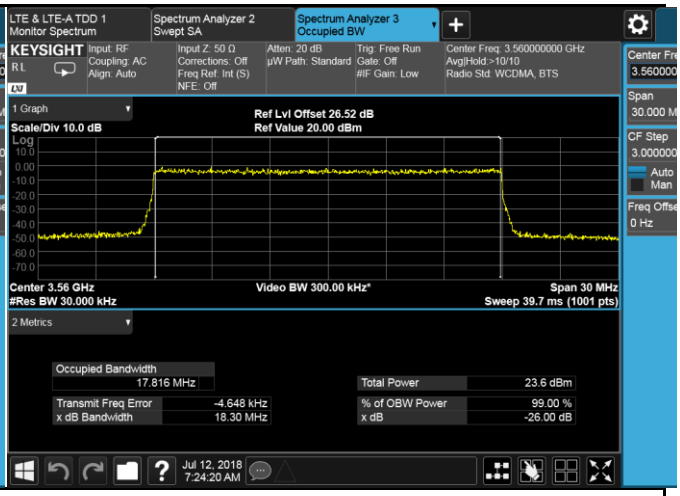
Test Data:

Type	Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Occupied Bandwidth (MHz)
10MHz BW, 64QAM	Low	3555	8.90	9.35
	Mid	3625	8.89	9.35
	High	3695	8.88	9.18
20MHz BW, 64QAM	Low	3560	17.81	18.30
	Mid	3625	17.76	18.29
	High	3690	17.79	18.31

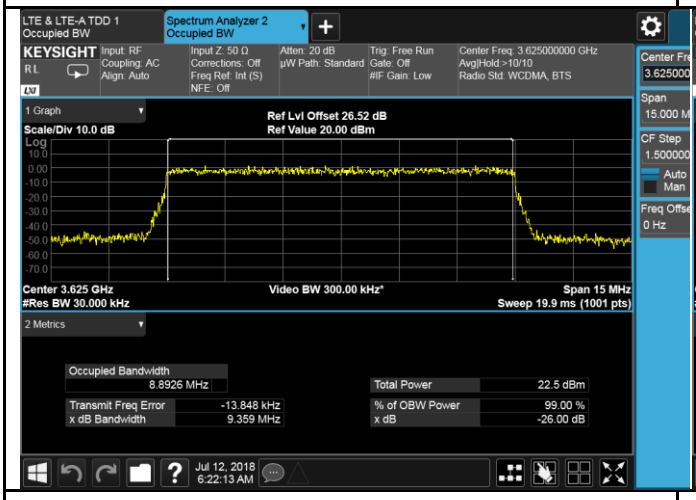
Test Plot for Occupied Bandwidth:



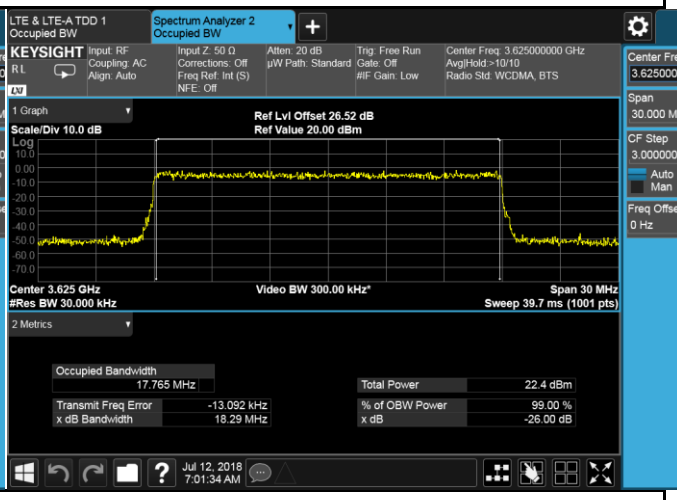
OBW-10M BW-Low



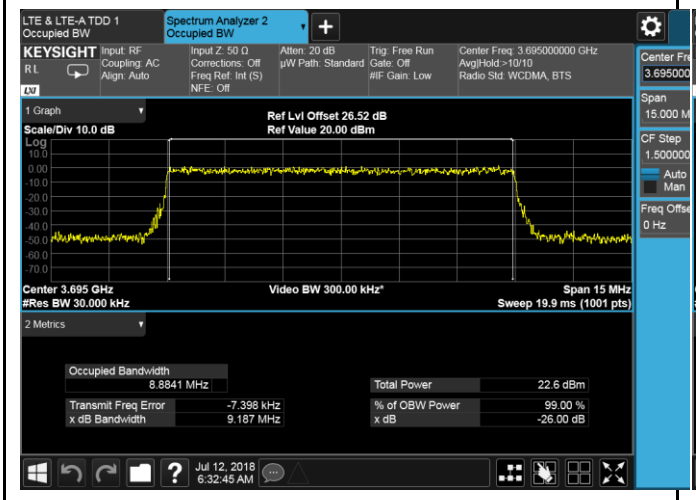
OBW-20M BW-Low



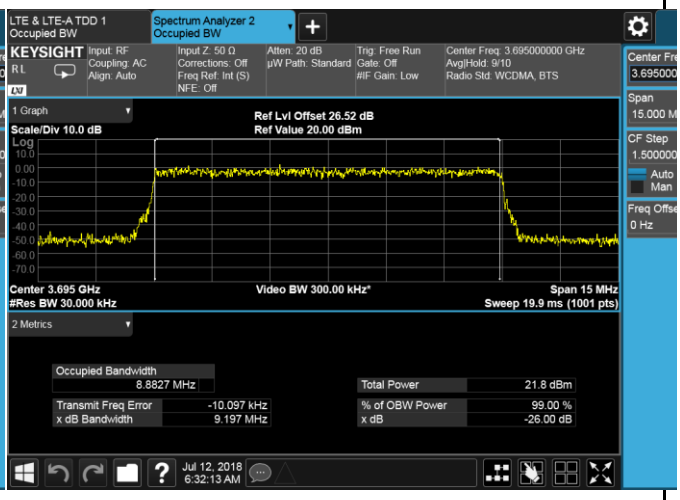
OBW-10M BW-Mid



OBW-20M BW-Mid



OBW-10M BW-High



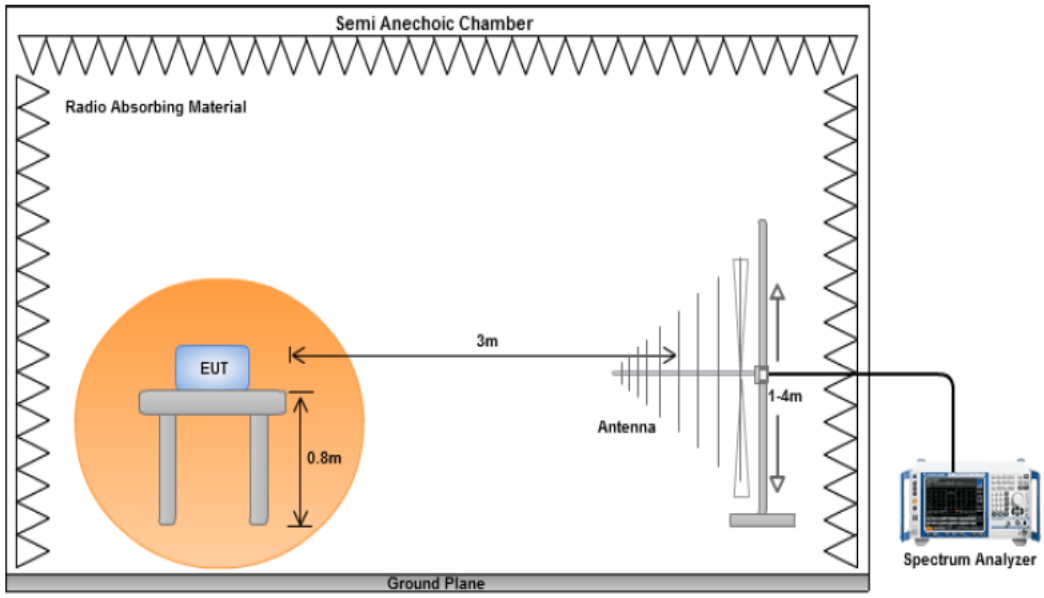
OBW-20M BW-High

10.5 Radiated Spurious Emission below 1GHz

Requirement(s):

Spec	Requirement	Applicable
47CFR96.41	*3.5 GHz Emissions and Interference Limits*—(1) *General protection levels.* Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed −25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.	☒

Test Setup



Test Procedure

Substitution method:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	07/11/2018	Environmental condition	Temperature	22°C
			Relative Humidity	48%
			Atmospheric Pressure	1008mbar

Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Limit calculation: Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.
Result	☒ Pass ☐ Fail

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at 10m chamber.

Radiated Emission Test Results for LTE band 48

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	22		
	Humidity (%)	45		
	Atmospheric (mbar):	1008		
Mains Power:	56VDC			
Tested by:	Chen Ge			
Test Date:	07/10/2018			
Remarks:	LTE band48-Mid CH-20MHz BW, 64QAM			

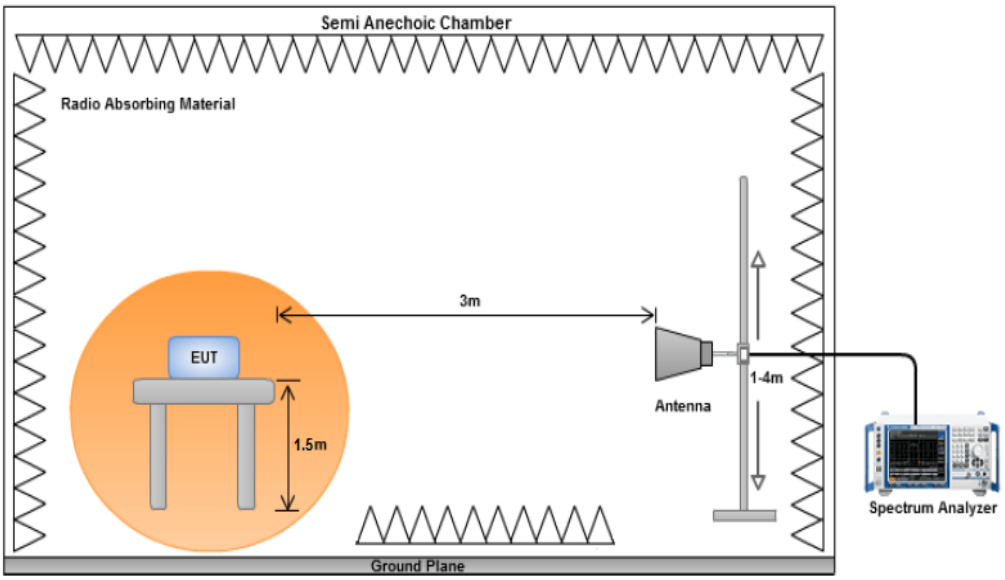
Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
214.56	219	108	V	214.56	-51.59	0	0.29	-51.88	-40	-11.88
214.56	128	211	H	214.56	-54.10	0	0.29	-54.39	-40	-14.39
645.25	8	165	V	645.25	-54.19	0	0.31	-54.50	-40	-14.50
645.25	266	298	H	645.25	-54.42	0	0.31	-54.73	-40	-14.73
799.85	248	108	V	799.85	-53.58	0	0.33	-53.91	-40	-13.91
799.85	144	185	H	799.85	-55.93	0	0.33	-56.26	-40	-16.26

The worst case limit -25dBm/MHz was used for evaluate.

10.6 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Requirement	Applicable
47CFR96.41	*3.5 GHz Emissions and Interference Limits*—(1) *General protection levels.* Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed −25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.	☒

Test Setup			
Test Procedure	Substitution method: 1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. 4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. 5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.		
Test Date	07/10/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Limit calculation: Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm		

	All different modulation and bandwidth configuration has been verified and only the test data of worst case with 64QAM modulation and greatest bandwidth was presented in this report.
Result	☒ Pass ☐ Fail

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Chen Ge at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Low Channel

Frequency (MHz)	Degree	Height	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
7120	154	144	V	7120	-56.71	11.54	3.63	-48.80	-40	-8.80
7120	89	211	H	7120	-54.47	11.54	3.63	-46.56	-40	-6.56
10680	219	196	V	10680	-53.1	10.99	4.51	-46.62	-40	-6.62
10680	118	149	H	10680	-53.31	10.99	4.51	-46.83	-40	-6.83

Mid Channel

Frequency (MHz)	Degree	Height	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
7250	299	148	V	7250	-52.31	11.54	3.63	-44.40	-40	-4.40
7250	18	166	H	7250	-55.9	11.54	3.63	-47.99	-40	-7.99
10875	184	155	V	10875	-51.76	10.997	4.51	-45.27	-40	-5.27
10875	197	149	H	10875	-53	10.997	4.51	-46.51	-40	-6.51

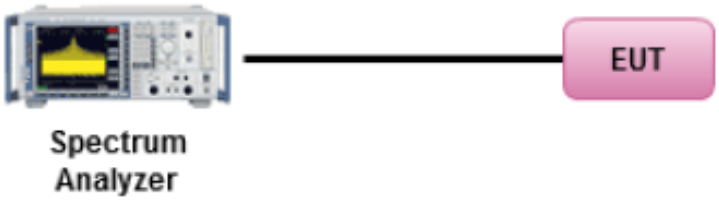
High Channel

Frequency (MHz)	Degree	Height	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
7380	204	108	V	7380	-53.40	11.33	3.63	-45.70	-40	-5.70
7380	79	149	H	7380	-54.92	11.33	3.63	-47.22	-40	-7.22
11070	284	108	V	11070	-52.85	11.119	4.52	-46.25	-40	-6.25
11070	154	155	H	11070	-53.44	11.119	4.52	-46.84	-40	-6.84

10.7 Frequency Stability

Requirement(s):

Spec	Item	Requirement	Applicable
47 CFR 2.1055, 47 CFR 96.41	-	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.	☒

Test Setup			
Test Procedure	The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference). 1. The equipment is turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter. 2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half hour is provided to allow stabilization of the equipment at each temperature level.		
Test Date	07/10/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure
Remark	NONE		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Chen Ge at RF Test Site.

Test Data:

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	56	20	3625000.015	15	0.004
100%		0	3625000.038	38	0.010
100%		10	3625000.027	27	0.007
100%		30	3625000.056	56	0.015
100%		40	3625000.042	42	0.012
115%	64.4	20	3625000.028	28	0.008
85%	47.6	20	3625000.041	41	0.011

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Spectrum Analyzer	N9010A	10SL0219	08/20/2017	1 Year	08/20/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2017	1 Year	08/12/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2017	1 Year	08/25/2018	☑
Horn Antenna (26GHz~40GHz)	AH-840	101013	08/28/2017	1 Year	08/28/2018	☑
Pre-Amp (30MHz~40GHz)	LPA-6-30	11140711	02/10/2018	1 Year	02/10/2019	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	08/20/2017	1 Year	08/20/2018	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
HongKong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio** : A1. Terminal equipment for purpose of calling **Telecom** : B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI**EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measuremet
Australia CAB Regocnition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2